

Decision-Making and Currency for C2 Systems

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Abstract

Case studies drawn from business and defence are used to demonstrate the importance of an individual's career trajectory in providing contextual knowledge for decision-making. This paper identifies successful and unsuccessful career trajectories, and discusses the implications for managing knowledge in higher-level headquarters.

1. Introduction

Developing automated command support systems at higher-level headquarters has proven problematic. User requirements keep changing due to novel situations (Clothier and O'Neill, 1994), or simply because a different person is posted into a role. Decision-making in these higher-level headquarters involves many informal group processes (O'Neill, 1995) that maybe overlooked in the design of automated command support systems.

The work of higher-level headquarters is as much about problem-framing as it is about problem-solving (O'Neill, 1996). As a result, contingency plans become resources for orienting people in a situation rather than prescriptions for action (Suchman, 1987; O'Neill, 1997).

Two parallel paths have been taken to investigate how to build better command support systems for higher-level headquarters. Firstly, studying the business world for ideas about coping with rapidly changing environments (O'Brien and O'Neill, 1998). Secondly, an ethnographic study of the Strike Group in the Royal Australian Air Force (RAAF) has revealed insights about how practice is maintained across generations of members.

This paper reports on parallel findings from the business and RAAF case studies. The common thread is the importance of individual career trajectories for enabling higher-level headquarters to function. The implications of these findings for higher-level headquarters are explored, with reference to the design implications of command support systems.

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2. Career Trajectories

The personnel function in organisations is responsible for designing a suite of career paths for the organisation. A *career path* aims to develop and maintain core competencies by moving people through a defined sequence of roles. The underlying assumption behind career paths is that individuals will accumulate knowledge that will prepare them for the next role. Career paths are an important organisational resource for managing future recruitment requirements, training requirements, and for enabling the organisation to evolve new competencies.

The realities of organisational life often result in divergences from the ideal path. People are increasingly performing roles outside their career path or advancing more quickly through their career paths. These changes have resulted from the needs of contingency situations, downsizing, outsourcing, and increased turnover rates in organisations.

One example in an air force context is that navigators are now staffing command positions which historically have been staffed by pilots. This new staffing arrangement is a consequence of the high turnover of pilots.

An implication of staffing outside career paths is that individuals are performing roles without the background knowledge that has previously been required.

A *career trajectory* represents the actual sequence of roles performed by an individual in their career. An individual's decision-making is shaped by the knowledge accumulated in their previous experiences. Their current experiences in turn shapes their future actions.

3. Case Studies

Four case studies will be examined. The first study is based on the negotiation of outsourcing contracts. The second case study focuses on how Ericsson produces senior managers through an extended apprenticeship process. The third study focuses on the career trajectory of a liaison officer in a higher-level headquarters. The fourth study focuses on the career trajectory of a commanding officer (CO) of a squadron.

3.1 Outsourcing

The telecommunications industry is evolving from electronics to electronic computers plus software. The core competencies of telecommunication companies, such as Ericsson, are changing from hardware competencies in electro-mechanical devices, such as relays and cross-bar switches, to software competencies. Wahlgren and Bergsten (1997) studied the characteristics of the growth in software as shown in Figure 1.

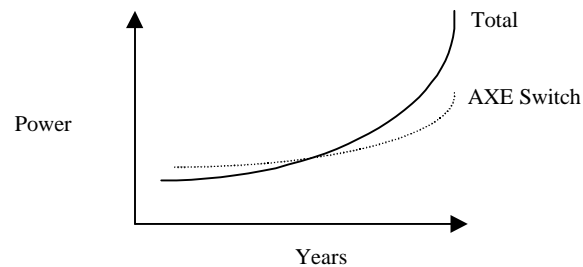


Figure 1. Characteristics of Software Growth

There is a significant, and increasing gap between the total software requirements of telecommunications systems, and that capable of being provided through Ericsson's traditional software development process. The major implication for addressing this gap is that Ericsson would need to significantly outsource its software development within the next five years.

Anderson and Backstad (1997) and Larsson and Dohlvik (1998) examined the organisational issues of outsourcing. The studies found that outsourcing primarily undertaken as a cost-saving exercise led to significant problems as illustrated by Sydney Water and Melbourne Gas. These problems meant that the population of Sydney had to boil their water for three weeks to counteract the existence of two serious parasites that had not been monitored, and the cessation of gas supplies to the city of Melbourne for over three weeks due to a plant maintenance failure.

The primary cause of these problems was the attempt to replace core human knowledge and competence with a written contract. Written contracts fail to capture:

- The need to continually train new people in the competency
- The competency evolves as the organisation evolves
- The organisation is reliant on the core competency and can't simply terminate the contract if delivery of services proves problematic

The determination, and long-term maintenance, of core competence in an organisation is vital (Lund and Nilsson, 1999).

Larsson and Dohlvik (1998) investigated outsourcing in the development of Motorola's Iridium Satellite system. Motorola outsourced 80-90% of this project, and was able to deploy core competence and enforce it across a range of sub-contractors. The methodology used was to apply Motorola's own core competences in the production of software to the initial selection process of the prospective subcontractors. This was in addition to checks on financial and organisational strengths. Motorola was then able to use its own organisational status relative to the much smaller

subcontractors to monitor and control the continuation of best practise development activities by the subcontractors.

The implication is that outsourcing becomes a core competency for organisations that outsource.

3.2 Producing Senior Managers

Figure 2 shows the career trajectory for a number of the senior staff; staff who are tagged as 'gatekeepers' from University onwards, notably from two specific degree courses. This structure is in contrast to the classic IBM structure of the 1980's, where the core competence was seen to be in marketing, but the IBM Fellowship channel encouraged the core technical competence.

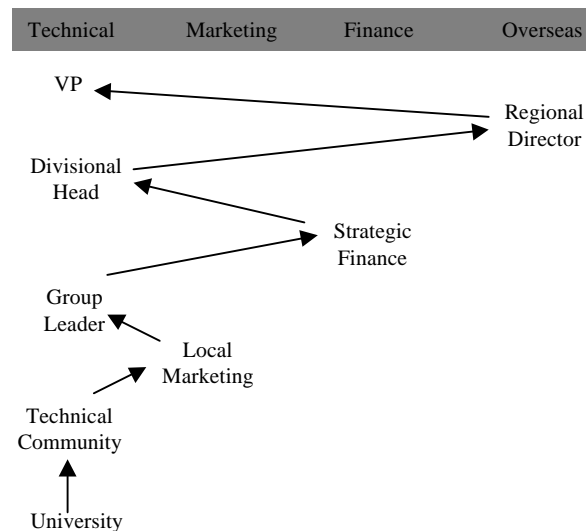


Figure 2. Executive Career Trajectory

The trajectory gives the staff member a significant period of time in each posting to demonstrate continuing ability, as well as becoming effective in the position. The overseas posts are of particular value as they not only provide understanding of different cultures and modes of business; they illustrate the nuances of working productively away from the Head Office.

Returning to the core technical area at progressively senior levels thus permits the application of skills learnt in other areas and from other senior managers. It also is intended to reinforce and update the core technical competence of the staff member.

Ericsson has tended to remain a hardware oriented organisation, with a natural conservatism within this orientation.

In the hardware design area this has been recognised so that major technology changes are achieved by creating new, geographically separate units. Meurling and Jeans (1995) illustrates the founding of Ellementel as such an organisation to develop the AXE-10 Switch.

The Radio Division at Kista became the focus for the mobile phone department; PBX's went to Anaheim California and GPRS is in Norway, as three further examples.

Within these organisational moves, the role of the gatekeepers is a critical one, as it is typically a gatekeeper who champions the significant change in technology. This was certainly the case in AXE, digital switches, and GSM.

A major problem in the telecommunications area has been the switch to software driven products. In Ericsson this has clearly been the case with an imperceptible change over in AXE from hardware to software costs, with the 50/50 point in 1995. The change has been masked by the spectacular growth in the hardware related mobile phone marketplace.

However, it has been almost impossible for staff at the senior and VP levels to maintain core competency as it shifts from hardware towards software. An example was reported in Affarer (1997) concerning the massive software driven losses on the AXE-N; the successor project to AXE-10.

This issue, of maintaining core competency at a senior level as technology changes is well illustrated for other groups such as AT&T (Bohlin, 1995).

3.3 *Liaison Officer*

What makes a good liaison officer? The simple answer is that a good liaison officer effectively contributes expertise about their functional area to the work of the headquarters.

Our ethnographic studies have revealed that being an expert in a functional area is not in itself sufficient for being a good liaison officer in a higher-level headquarters. Figure 3 shows an ideal career trajectory for a liaison officer working in a higher-level headquarters.

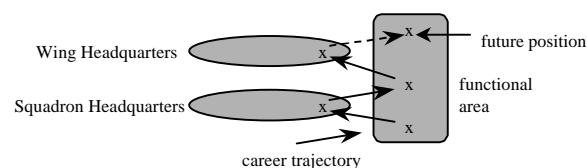


Figure 3. Career trajectory for an Liaison Officer

The individual's initial posting is in their functional area where they develop some competency. The individual is posted to a squadron headquarters as a liaison officer, before returning to their functional area to continue developing competency. The individual is then posted to the wing headquarters before continuing their career in the functional area.

For a liaison officer in a wing headquarters, an earlier posting as a liaison officer in the squadron headquarters is critical. Individuals who have followed this career trajectory are productive at the wing headquarters within a month. Individuals who have not served as a liaison officer at a squadron headquarters prior to becoming a liaison officer at wing headquarters are often struggling six months into their posting at the wing headquarters.

An insight into this finding is that a liaison officer is not about being a deep domain expert in a functional area. Instead, liaison officers are experts at knowing how their functional area inter-relates with the work of the organisation, and leveraging their social networks to enable these inter-relationships to continue working effectively.

The posting as a liaison officer at squadron headquarters enables an individual to learn how the functional areas inter-relate in the day-to-day activities associated with conducting missions. This knowledge is invaluable for situating the longer-term planning conducted at the higher-level headquarters.

3.4 CO of a Squadron

A question that has reappeared in a number of our studies is “how does an individual learn to be a commanding officer (CO)”? The universal response has been that by the time a person reaches the CO position they “should know how to be a CO”. This is not very helpful from a task/information/decision analysis perspective.

Our ethnographic studies have revealed a common career trajectory for becoming a CO in the RAAF as shown in Figure 4. The individual is initially posted to a squadron and develops competence as an aircrew member. The individual is then posted sideways to another part of the organisation. For example, pilots may become Qualified Flying Instructors (QFI). The individual’s next posting will be back to the squadron in a position that involves both flying and formal organisational responsibilities in squadron headquarters, for example, being appointed a flight commander. The individual’s next posting will be to a higher-level headquarters serving in a staff position or as an executive officer (XO). The individual is then sent to Staff College before being posted as a CO.

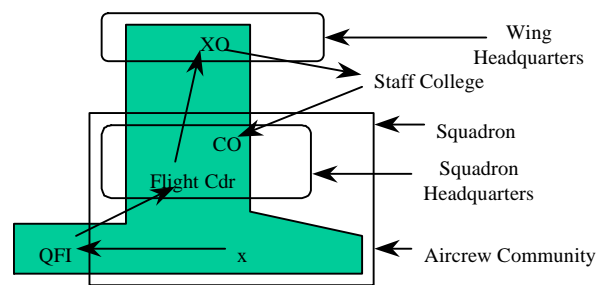


Figure 4. CO Career Trajectory

There are variations that occur within this career trajectory for different people: they may spend longer in the aircrew community, they may get posted sideways for different positions for different lengths of time, they may get an overseas posting, there may be intermediate postings between the higher-level HQ – Staff College – CO positions.

The career trajectory for a CO enables the individual to acquire different types of knowledge:

- Detailed knowledge of being an aircrew member, planning for and flying on missions.
- An understanding of how the functional areas of the organisation inter-relate to enable missions to be flown on an ongoing basis (posting at Squadron HQ).
- An appreciation of what it is like to work for a good CO within a squadron. This appreciation is developed by multiple postings within a squadron that enable the individual to see other people performing the CO role, and experience strategies which are / are not successful.
- An appreciation of the CO’s role external to the squadron through the posting to a higher-level headquarters

The key knowledge gained in this career trajectory is how the different activities in the organisation inter-relate, how to keep these activities aligned in problematic situations, and how to change these alignments in novel situations.

The purpose of Staff College is not to convey a body of material to the students. Instead, Staff College provides a setting for reinforcing the knowledge about the inter-relationships in the organisation. This setting enables the formal discussion of the inter-relationships in the organisation, and the organisational changes on the horizon. The Staff College also provides a setting for informal story-telling between peers about what it means to be a good commander.

4. Discussion

4.1 Currency

The major theme in the Ericsson case studies is the need to maintain currency. *Currency* is the direct hands on knowledge of the core competencies of the organisation's environment.

The Ericsson case study shows that outsourcing is successful if the organisation retains and maintains knowledge of the core competency and uses this competency in negotiating and maintaining contracts. Similarly, performing a liaison role in a higher-level headquarters is more successful if an individual has performed a liaison role at a lower-level headquarters.

The Ericsson case studies have shown that the problems in appreciating and acquiring core competencies as the technology or organisational possibilities change is extremely difficult at a senior management level.

Defence is equally susceptible to these problems as illustrated by the TSR2 strike aircraft in the 1960s being required to operate from unprepared airstrips as senior officers had done in World War 2.

In the air force, it is important that "one stars" in their last flying role actually fly to retain currency for their future careers in the military.

4.2 Knowledge Management

Knowledge management and corporate memory activities have focused on the storage and reuse of explicit knowledge.

The career trajectories identified in this paper have revealed another type of knowledge that is not currently captured by existing knowledge management and corporate memory activities. Connerton (1989) calls this knowledge our "habit memories", knowledge that is embodied in practice.

Organisations have traditionally managed this type of knowledge through the use of career paths. Cost-cutting pressures are negating our ability to manage knowledge through the career path system. Consider that major joint exercises are now being conducted less frequently, in some cases every four years. If we assume a two year posting cycle, this means that half the people

performing a role will not get to experience the inter-relationships exercised during a major joint exercise, taking away many of the benefits of the career path.

A major challenge for the personnel community is to find a mechanism for making visible the knowledge encoded in career paths as a factor for decision-making.

4.3 Workflow Systems

An alternative to moving people in and out of functional areas is to devise standards that enable these functional areas to inter-relate without human intervention. For example, electronic tasking boards enable multiple functional areas to automatically schedule resources simply by selecting an available slot.

The underlying assumption is that there is no need for a single person to be accountable for how the scheduling system works. Instead the knowledge can be loosely scattered across many people in many functional areas.

The problem with this approach is that it assumes that the scheduling solution is generic enough to handle all situations that may be encountered.

4.4 Decision Support Aids

Decision support aids are designed to facilitate the performance of some part of a role's work. However, there are many underlying assumptions about the background knowledge required to perform the work and use the decision support aid.

If an individual's career trajectory is different from the ideal career path, then the decision support aid may not be used because the individual does not have the background knowledge to use this tool.

4.5 Strategic and Operational-Level Headquarters

Individuals are posted to staff positions in strategic and operational-level headquarters as a "one-off" as part of their career development. Consequently, there is little continuity of practice across generations of members, and newcomers often don't have the appropriate baseline of knowledge.

An alternative would be to develop a career path that alternates postings in a functional area with postings in headquarters environments. For example, in an Australian context, an individual could be posted to a staff position at NORCOM, then two postings later to a staff position at HQAST, then two postings later to a staff position at HQADF.

The advantages of developing a career path for headquarters staff would be:

- To develop a cadre of staff with knowledge of staff work practice.
- To develop understanding of how the tactical, operational and strategic levels of command and control are related, and inter-related.
- Use this understanding to develop more effective command and control systems at the strategic and operational levels.
- Alternate postings back into the individual's functional area ensures that the individual periodically updates their currency in the organisation's core competency, as well as developing a new core competency in staff work.

5. Conclusions

Career paths represent an idealisation of the accumulation of organisational knowledge in individuals whereas career trajectories represent the actual accumulation of organisational knowledge.

Large divergences between career paths and career trajectories result in:

- Reduction of expertise in an organisation
- Failure to appropriately "seed" future senior managers
- Failure to align and re-align functional areas to achieve the mission
- Failure to exploit decision support aids fully
- Lack of currency in the organisation's core competencies by senior managers results in failure to exploit new technologies and work practices
- Failure to develop informal social networks that provide the infrastructure for effective, formalised decision-making

Alternating career trajectories are an effective strategy in developing the future leadership of an organisation.

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